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(54) A key and lock assembly.

(57) An improved key and lock assembly in which an electronically coded circuit (100) is embedded in the handle (12) of a key (10) and at least one electrical terminal (16,18) extends from the handle (12) adjacent to and electrically isolated from the key shank (14) so as to contact a similarly located and biased terminal (25) on the lock assembly (20) when the key is fully inserted therein.

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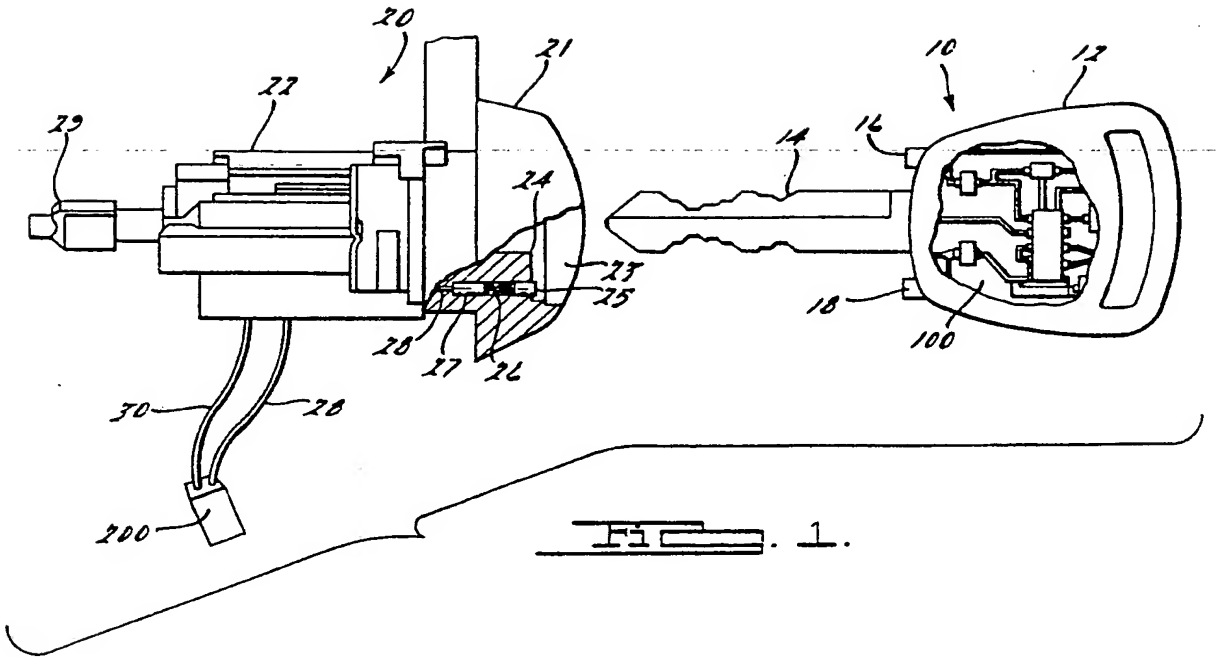

Fig. 1.

A KEY AND LOCK ASSEMBLY

The present invention relates to a key and lock assembly.

Recently, several concepts have been patented in which a conventional tumbler actuating key is combined with an auxiliary coding mechanism in order to provide a higher degree of security by increasing the number codes beyond those available on a conventional tumbler actuated keys.

In U.S. Patent No. 4,200,227 a conventional tumbler actuating key is described as containing a coded electrical circuit that is responsive to short wave radiation. The circuit is embedded within a plastic assembly that is welded or otherwise bonded to the key handle so that the electrical circuit is isolated away from the surface of the key.

In U.S. Patent No. 4,298,792 a conventional key is shown as containing a coded track along its shank. The key is shown to contain a single code track composed of alternating light and dark fields that are read by sensors in the vicinity of the receiving aperture of the lock. The sensors read the track as the key is inserted into the lock.

In U.S. Patent No. 4,366,466 the use of a conventional key is described, which additionally includes a housing for a data carrier. The data carrier is described as containing information on, for example, a recording tape, a recording wire, an optically scannable medium or other conventional medium. The data carrier is further said to include either an unerasable portion containing data reflecting vehicle-related information or an erasable portion containing arbitrary information.

According to the present invention, there is provided a key for use in a security system which utilises a tumbler movable lock which is unlocked by the insertion of a key shank (14) cut to correspond to the unlocked tumbler configuration, wherein the key (10) comprises a handle portion (12) connected to said shank (14) and sized for manual gripping of the key (10), at least one electrical terminal (16,18) extending from said handle portion (12) adjacent to and electrically isolated from said shank (14), and means (100) within said handle portion (12) and connected to said at least one electrical terminal (16,18) for providing a predetermined digital code to said electrical terminal. The invention will now be described further, by way of example, with reference to the accompanying drawings, in which :

Figure 1 illustrates the preferred embodiment of the key and lock assembly of the present invention.

Figure 2 is a circuit diagram of the electronic coding circuit within the handle of the key of the present invention.

In Figure 1, the improved key 10 and the improved lock assembly 20, which embody the present invention, are illustrated. The key 10 includes a conventional cut shank 14 preferably of steel or brass in a double cut pattern. A handle portion 12 is formed at the upper end of the shank 14 and contains an electronically coded circuit 100 embedded therein. Electrical terminals 16 and 18 are shown provided as extending from the handle 12 adjacent to and electrically isolated from the shank 14.

The lock assembly 20 includes an electrically isolated receptacle end 21 with an aperture 24 and an opening 23 for receiving the shank 14 of the key 10 when inserted therein. Provided the cuts on the shank 14 conform to the tumbler arrangement within the lock mechanism 20, the shank 14 will continue to be inserted fully into the body 22 of the lock 20. Upon full insertion, the electrical terminal 16 and 18, as well as the leading edge of the handle 12 will be received into the opening 23. If the key is inserted as shown in Figure 1, electrical terminal 18 will contact a biased electrical terminal 25 extending from the isolated portion 21 of the lock 20. The electrical terminal 25 is biased through a conducting spring 26 and is in electrical connection with a fixed terminal end 27 and a conductor 28. The end of the conductor 28 is shown terminated into a conventional electrical connector 200. The body 22 of the lock mechanism 20 is preferably formed of a conducting metal and provides intimate electrical contact with the shank 14 of the key 10 when it is properly inserted. The lead wire 30 provides a ground connection between the body 22 and the connector 200.

A mechanical actuator 29 is shown extending from the body 22 on a shaft and is typical in mechanical locks of this type to provide mechanical connection to other mechanical or electrical actuated devices. In an automotive vehicle, the actuator 29 is typically connected to an ignition switch and a mechanism for freeing the steering column prior to start up.

Although not shown in this application, the purpose of the improved key assembly shown in Figure 1 is to provide additional security so that an associated anti-theft control system within the vehicle will interrogate the electronics of the key to verify that the key is actually the one intended for the same vehicle prior to enabling the start circuit for vehicle operation.

Figure 2 is an embodiment of the circuit 100 embedded within the handle 12 of the key 10. The circuit comprises a 10 KHz clock circuit 120, and 8-bit shift register 110, an 8-bit counter 130 and a

permanently coded element formed by conductors 111-118.

The 50 KHz clock 120 responds to a regulated DC input (5-10 volts) at either terminal 16 or 18 via the spring biased terminal 25 on the lock 20 when fully inserted therein. The DC input is also regulated by the resistor 101 and capacitor 102 which serve to isolate the clock circuit 120 from data modulations that are placed on the DC power line. The clock circuit 120 is also connected to ground through the key shank 14 when the key is inserted into the grounded lock assembly 20. Two multivibrator circuits 125 and 126 are interconnected to provide oscillation in response to the application of the DC input signal. Capacitors 123 and 124 are selected along with resistors 121 and 122 to provide appropriate RC time constants that determine the frequency and duty cycle of the clock signal. While Applicants have selected 10 KHz as the output frequency, it should be noted that the frequency is not critical to operation of the invention but is selected to synchronize with the security system module for reading the output signal from the key.

The permanently coded portion of the circuit is shown as made up of printed circuit conductors 111-118 initially interconnected between the 5 volt power bus and ground. Subsequently, but prior to permanent encapsulation within the handle of the key, the conductors are randomly cut so that the potential present on the conductors is either 5 volts or ground. In the example shown in Figure 2, the cuts in the conductors result in the code 00101111 present at the I/O ports 0-7 of the 8-bit shift register 110. If the least significant bit of the code is always "1", 2^7 code possibilities are available for selection.

In operation, when the key is inserted into the lock 20 the shank is held to ground potential and 5 volts DC is supplied to either electrical terminal 16 or 18, depending upon orientation of the key. The 10 KHz clock 120 responds to the applied potential to produce pulses which are input to both the "Clk" terminals of the 8-bit shift register 110 and the 8-bit counter 130. After each eight clock pulses, the counter 130 outputs a signal to the "p/s" terminal of the 8-bit shift register 110 which causes the shift register to read the input voltages available at the coded conductors connected to the I/O ports 0-7. Subsequent clock signals on the Clk terminal of the register 110 cause the eight voltage levels read at I/O ports 0-7 to be sequentially output as a binary bit stream. The output from the 8-bit shift register is provided to resistor 104 and through coupling capacitor 103 to modulate the 5 volt signal on the electrical terminal 16 and 18. In this manner, the 8 bit code is sequentially clocked back through the conductor 25 of the lock assembly 20 and conveyed through the electrical connector 200 to the associated security system control module.

While the aforementioned circuit includes a coded device in the form of cut conductors on a printed circuit board, it is invisioned that electrically programmable or other nonvolatile memory devices may be employed where economy or performance requirements dictate.

Claims

1. A key for use in a security system which utilises a tumbler movable lock which is unlocked by the insertion of a key shank (14) cut to correspond to the unlocked tumbler configuration, wherein the key (10) comprises a handle portion (12) connected to said shank (14) and sized for manual gripping of the key (10), at least one electrical terminal (16,18) extending from said handle portion (12) adjacent to and electrically isolated from said shank (14), and means (100) within said handle portion (12) and connected to said at least one electrical terminal (16,18) for providing a predetermined digital code to said electrical terminal.

2. A key as claimed in Claim 1, wherein said key shank is electrically conductive and electrically connected to said code providing means.

3. A key as claimed in Claim 1 or 2, including a pair of electrical terminals extending from said handle on either side of said shank, electrically isolated from said shank and commonly connected to each other.

4. A key as claimed in Claim 3, wherein said pair of electrical terminals are commonly connected to each other through said code providing means.

5. A key as claimed in any one of the preceding claims, wherein said code providing means contains circuitry that is responsive to an electrical potential applied between said key shank and at least one terminal to provide a digital signal output having a predetermined bit code.

6. A key as claimed in Claim 5, wherein said code providing means includes an oscillator circuit which provides clocking pulses at a predetermined rate in response to the application of said electrical potential, storage means for permanently storing a predetermined bit code, and means connected to said oscillator circuit and said storage means for periodically reading said predetermined bit code in said storage means and sequentially outputting individual bits of the read predetermined bit code in response to each clocking pulse.

7. A key as claimed in Claim 6, wherein said reading and outputting means provides said digital output signal in the form of individual bits to at least one of said electrical terminals.

8. A key as claimed in Claim 7, wherein said handle is formed of a moulded insulating material that encapsulates said code providing means.

9. A tumbler lock mechanism in a security system for use with a key as claimed in any one of the preceding claims, the mechanism including means aligned with the tumblers for receiving the key shank, means adjacent the receiving means for providing electrical contact with at least one electrical output terminal on said key when fully inserted into said receiving means, and means connected to said contact means for providing electrical communication between said key and said system.

10. A mechanism as claimed in Claim 9, wherein said contact means includes a conductive brush and a biasing spring, whereby said biasing spring provides compressive forces against said conductive brush and said electrical output terminal on said key when fully inserted into said receiving means.

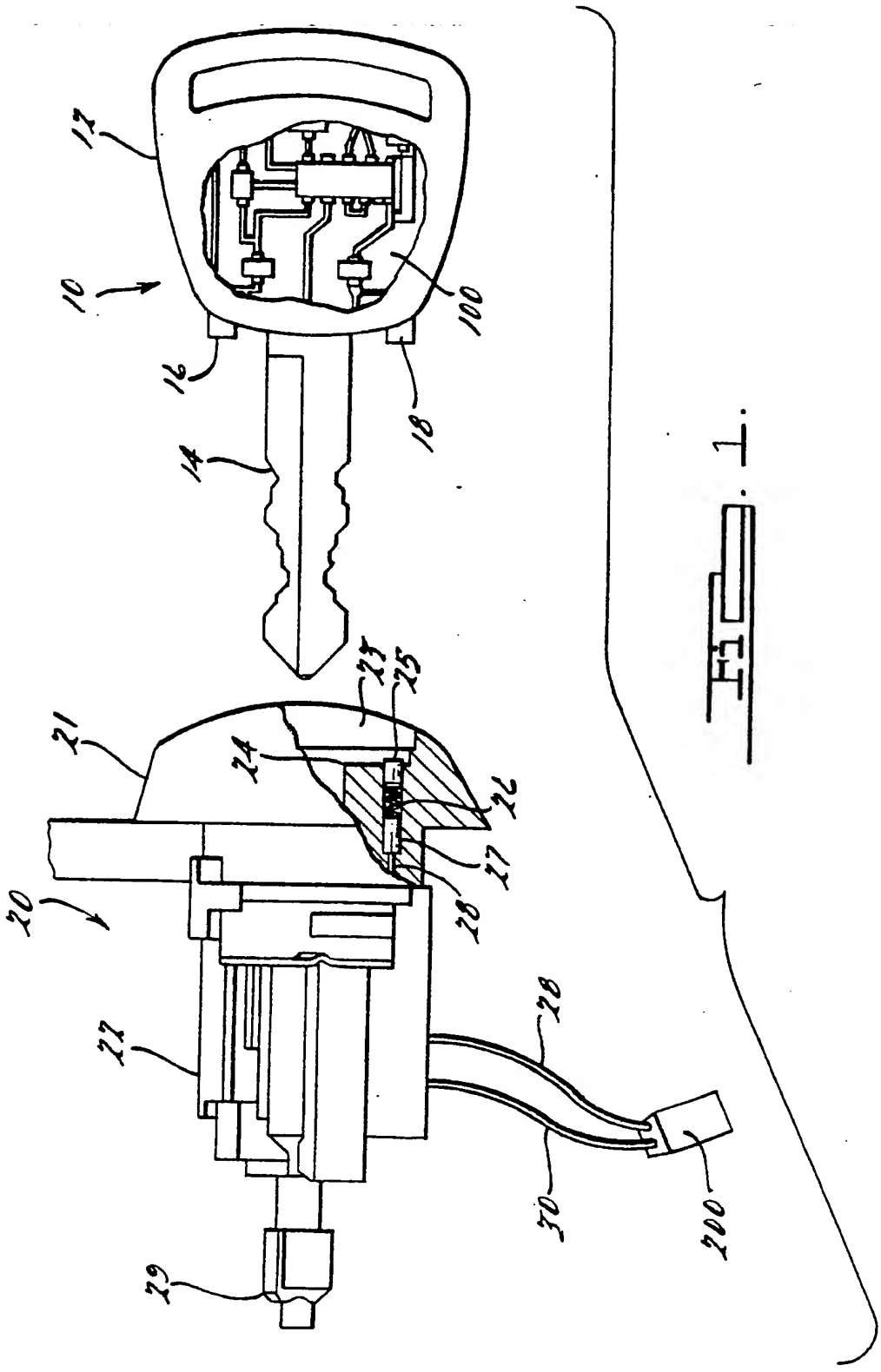

Fig. 1.

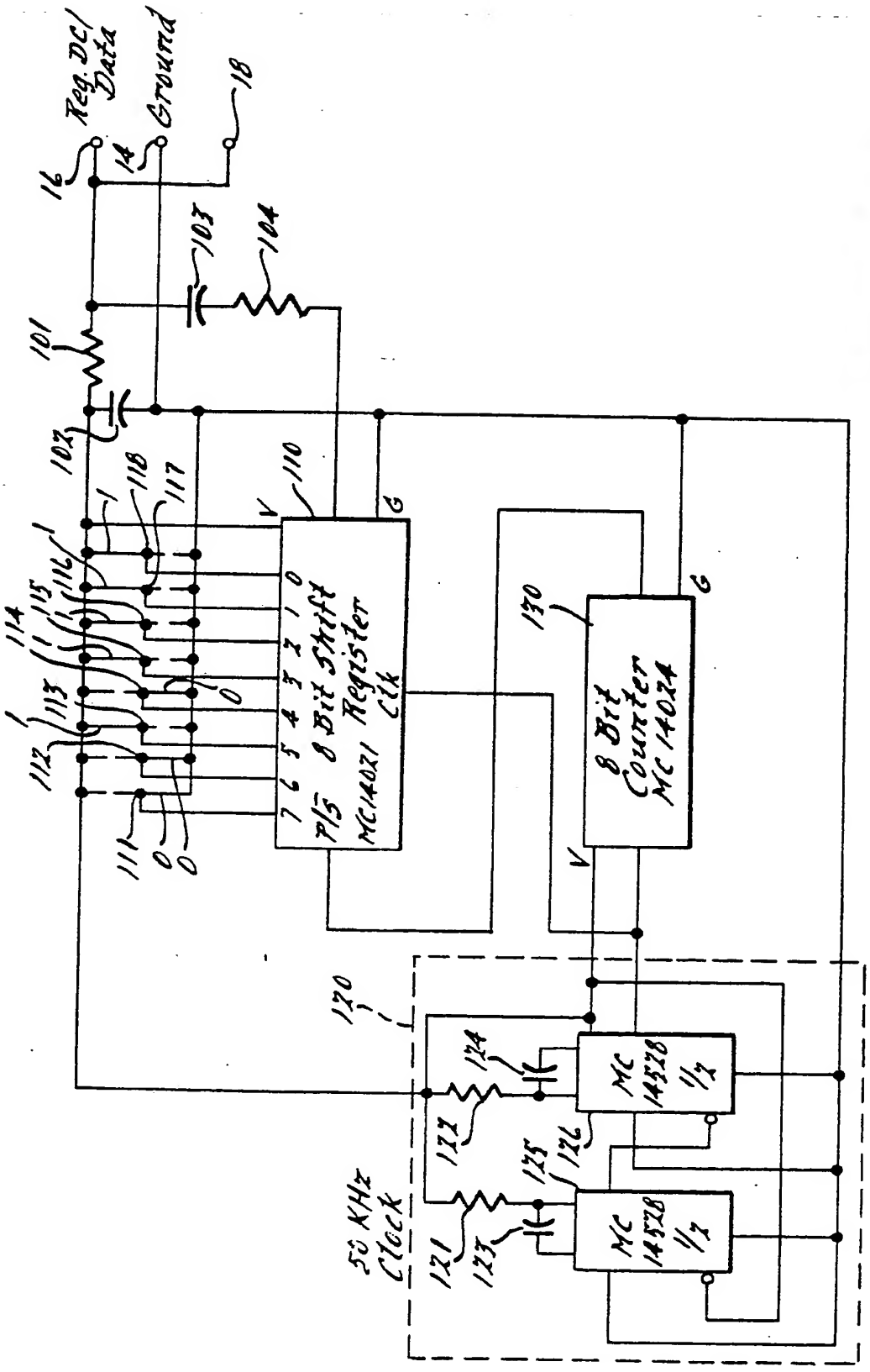
Reg. DC/ Data
Ground
16
14
18
101
102
103
104
110
V
G
P/S 8 Bit Shift Register
MC14021
Clk
7 6 5 4 3 2 1 0
111
112
113
114
115
116
117
118
130
8 Bit Counter
MC14024
120
124
122
125
126
121
123
50 KHz Clock
MC 14528
1/2
MC 14528
1/2

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 87311540.6

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
A	DE - A1 - 3 125 827 (NEIMANN GMBH & CO KG) * Fig. 1-8 * --	1-4,8, 9,10	E 05 B 49/00
A	US - A - 4 232 353 (MOSCIATTI, FOLEY, MORITZ) * Fig. 3,16-22; claims 1-49 * --	1-3,5, 6,7	
A	GB - A - 2 158 870 (OY WARTSILA) * Fig. 1-7; claims 1-17 * --	1-6,8, 9,10	
D,A	US - A - 4 200 277 (J.H. LEMELSON) * Claims 1-6; fig. 1-3 * --	1-5,8	TECHNICAL FIELDS SEARCHED (Int Cl 4)
D,A	US - A - 4 298 792 (BSG - SCHALT-TECHNIK GMBH & CO) * Claims 1-10 * ----	1-7,9	E 05 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	10-05-1988	CZASTKA

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